

[Designation of Document] Description

[Title of the Invention] INFORMATION PROVIDING APPARATUS FOR VEHICLE

[Technical Field]

The present invention relates to an information providing apparatus for a vehicle, and particularly to an information providing apparatus for a vehicle which includes an aural information providing unit and can support automatic traveling, such as cruise-control driving, of the vehicle by providing a driver the aural information from the aural information providing unit.

[Background Art]

As an information providing apparatus for a vehicle, there is one that uses a navigation apparatus and outputs various information relating to an input mode, a set point and the like by voice sound when an objective point is set or an auto-cruise traveling section of the vehicle is set, which detail is disclosed in patent document 1. Besides, in an information providing apparatus for a vehicle using voice sound, there is one that includes an audio mute unit to reduce the voice sound output of audio equipment at the time of outputting warning message, which detail is disclosed in patent document 2. Further, in an information providing apparatus for a vehicle, there is one that changes an expression mode such as a tone color in voice sound synthesis, which detail is disclosed

in patent document 3.

[Patent document 1] JP-A-11-99851

[Patent document 2] JP-A-9-73588

[Patent document 3] JP-A-11-224095

[Disclosure of the Invention]

[Problems that the Invention is to Solve]

In the information providing apparatus for the vehicle disclosed in patent document 1, although the operability of an operation part of cruise-control driving is improved by the voice sound output, it was necessary to improve the notification process of a traveling state to a user (especially a driver) in the automatic traveling such as cruise-control driving. Since the information providing apparatus for the vehicle disclosed in patent document 2 has the structure including the audio mute unit, the driver certainly hear the warning message and can perform a suitable process, however, another improvement was necessary to carry out the user-customized registration of aural information according to the user's preference. Besides, in the information providing apparatus for the vehicle disclosed in patent document 3, the user's understanding on the given information can be deepened and the convenience for the user is enhanced by changing the reproduced voice sound to differentiate from the original sound, however, similarly to patent document 2, it was necessary to improve the user-customized registration

of aural information according to the user's preference.

Taking the foregoing problems into consideration, in an information providing apparatus for a vehicle including an aural information providing unit to aurally notify various states of a vehicle, the invention enables the aural information providing unit whose mounting rate on the vehicle is predictable to become higher to be applied to automatic traveling such as cruise-control traveling, enables the provision of the information providing apparatus for the vehicle according to the user's preference by using a user-customized function of the aural information providing unit, and provides the information providing apparatus for the vehicle in which the eye movement of the user during traveling can be reduced by using the aural information providing unit.

[Means for Solving the Problems]

In order to solve the foregoing problems, as described in an information providing apparatus for a vehicle recited in claim 1, the invention is an information providing apparatus for a vehicle including an aural information providing unit to aurally notify various states of a vehicle, and a control unit that inputs traveling information relating to automatic traveling of the vehicle and operation information relating to the automatic traveling for a user through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information

providing unit to provide the user at least one state of a vehicle relating to the automatic traveling, a warning relating to the automatic traveling, a guidance of an operation relating to the automatic traveling, and an answer-back system of the operation relating to the automatic traveling.

Besides, according to an information providing apparatus for a vehicle as recited in claim 2, in the information providing apparatus for the vehicle as recited in claim 1, a visual information providing unit is provided to visually display the various states of the vehicle, and the control unit causes a display mode relating to notification content of the aural information providing unit to be displayed by the visual information providing unit.

Besides, according to an information providing apparatus for a vehicle as recited in claim 3, in the information providing apparatus for the vehicle as recited in claim 1, the control unit uses the aural information providing unit to send a notification by voice sound.

Besides, according to an information providing apparatus for a vehicle as recited in claim 4, in the information providing apparatus for the vehicle as recited in claim 1, the control unit uses the aural information providing unit to send a notification by a combination of a voice sound and a sound effect.

Besides, according to an information providing apparatus

for a vehicle as recited in claim 5, in the information providing apparatus for the vehicle as recited in claim 4, the control unit activates the aural information providing unit to provide the sound effect according to various states of the guidance, the warning and the answerback, and changes the sound effect based on each of the various states.

Besides, as described in an information providing apparatus for a vehicle recited in claim 6, an information providing apparatus for a vehicle of the invention is an information providing apparatus for a vehicle including an aural information providing unit to aurally notify various states of a vehicle, and the control unit inputs information of the vehicle through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information providing unit for at least warning content in the information by a combination of a sound effect and voice sound, and changes the sound effect for each warning content.

Besides, according to an information providing apparatus for a vehicle as recited in claim 7, in the information providing apparatus for the vehicle as recited in claim 6, the control unit repeatedly activates the aural information providing unit for the warning content by the combination of the sound effect and voice sound, and activates the aural information providing unit by only the sound effect in the

repeated operation after operating the aural information providing unit for a specified number of times.

Besides, as described in an information providing apparatus for a vehicle recited in claim 8, an information providing apparatus for a vehicle of the invention is an information providing apparatus for a vehicle including an aural information providing unit to aurally provide a user various states of a vehicle, and a control unit that inputs information of the vehicle through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information providing unit to provide a user content of at least one of an opening and ending based on the information.

Besides, according to an information providing apparatus for a vehicle as recited in claim 9, in the information providing apparatus for the vehicle as recited in claim 8, the control unit activates the aural information providing unit by mixing of a voice sound and music.

Besides, according to an information providing apparatus for a vehicle as recited in claim 10, in the information providing apparatus for the vehicle as recited in claim 6 or 8, the control unit activates the visual information providing unit as well as the aural information providing unit simultaneously.

Besides, as described in an information providing

apparatus for a vehicle recited in claim 11, an information providing apparatus for a vehicle of the invention includes a visual information providing unit to visually display various states of a vehicle, an aural information providing unit to aurally notify the various states, and a control unit to control the visual information providing unit and the aural information providing unit, in which the control unit inputs information of the vehicle through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information providing unit base on a information relating to at least warning content in the information, and activates the visual information providing unit as well as the aural information providing unit simultaneously.

Besides, according to an information providing apparatus for a vehicle as recited in claim 12, in the information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, a time information gathering unit is provided to gather time information, and the control unit inputs the time information and provides information corresponding to the time information by the aural information providing unit.

Besides, according to an information providing apparatus for a vehicle as recited in claim 13, in the information providing apparatus for the vehicle as recited in claim 12,

the time information gathering unit includes an electric wave clock or a GPS.

Besides, according to an information providing apparatus for a vehicle as recited in claim 14, in the information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, when activating the aural information providing unit, the control unit outputs an instruction signal to reduce output of an audio device mounted in the vehicle through at least one of the vehicle information terminal and the multiplex communication input/output terminal.

Besides, according to an information providing apparatus for a vehicle as recited in claim 15, in the information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, when detecting more than one conditions for aural notification through at least one of the vehicle information terminal and the multiplex communication input/output terminal, the control unit activates the aural information providing unit to sequentially provide a user respective information corresponding to the respective conditions in a previously determined descending order of priority.

Besides, according to an information providing apparatus for a vehicle as recited in claim 16, in the information providing apparatus for the vehicle as recited in claim 15, when a signal indicating that information on a waiting list



is cancelled, the signal is inputted through at least the vehicle information terminal and the multiplex communication input/output terminal at the time when the information are sequentially provided to the user in the descending order of priority, the control unit cancels the notification operation of the information corresponding to this signal.

Besides, according to an information providing apparatus for a vehicle as recited in claim 17, in the information providing apparatus for the vehicle as recited in claim 15, in a case where the number of information not notified and being on a waiting list is larger than the number of a specified information, the control unit leaves a specified number of information with high priority as they are and omits a notification operation of the other information.

Besides, according to an information providing apparatus for a vehicle as recited in claim 18, in the information providing apparatus for the vehicle as recited in claim 15, when emergency information is inputted through at least one of the vehicle information terminal and the multiplex communication input/output terminal at the time more than one information are sequentially provided in accordance with the priority, the control unit forces the information requiring the urgency into the information not provided and being on a waiting list, and causes the information requiring the urgency to be provided with the priority by the aural information

providing unit.

Besides, according to an information providing apparatus for a vehicle as recited in claim 19, in the information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, has the control unit includes a user-customized mode to register various settings of the aural information providing unit, an input unit to determine contents of the various settings in the user-customized mode, and a storage unit to register the contents of the various settings.  
[Effects of the Invention]

According to the invention, in the information providing apparatus for the vehicle using the aural information providing unit, since the notification of the traveling state of the vehicle and the warning (alarm) output are performed by voice sound, the situation determination at the time of automatic traveling, such as cruise control driving, can be easily made, and the eye movement of the user to confirm the display information during driving can be reduced, and the information providing apparatus for the vehicle which contributes to the safety driving can be obtained. Besides, since the guidance relating to the operation of automatic traveling, such as cruise control driving and the answer-back system are outputted by voice sound, the operability for the user can be improved. Further, since it becomes possible to customize various setting contents for each user, the various settings according to the

user's preference is possible, and the convenience can be improved.

[Brief Description of the Drawings]

Fig. 1 is a schematic view showing an information providing apparatus for a vehicle in an embodiment of the invention.

Fig. 2 is a block diagram of the information providing apparatus for the vehicle in the embodiment.

Fig. 3 is a view showing an operation of an aural information providing unit and a visual information providing unit in the embodiment.

Fig. 4 is a view showing warning information in the embodiment.

Fig. 5 is a view showing an operation at a time of opening/ending in the embodiment.

Fig. 6 is a view showing sound mixing in the embodiment.

Fig. 7 is a view showing a process when aural information overlaps in the embodiment.

Fig. 8 is a view showing a first process when warning information occurs in the embodiment.

Fig. 9 is a view showing a second process when warning information occurs in the embodiment.

Fig. 10 is a view showing a third process when warning information occurs in the embodiment.

Fig. 11 is a view showing an example of a process in the

embodiment.

Fig. 12 is a view showing a process in a case a control unit has urgency information in the embodiment.

Fig. 13 is a view showing a user-customized mode in the embodiment.

[Best Mode for Carrying Out the Invention]

Hereinafter, embodiments of the invention will be described with reference to the accompanying drawings.

Fig. 1 is a schematic view of an example of an information providing apparatus for a vehicle. An information providing apparatus 100 for a vehicle includes a display part 101 (for example, a liquid crystal display device (LCD) of TFT or the like) as a visual information providing unit to provide various information displays, a tachometer 102, a fuel meter 103 and a thermometer 104.

Fig. 2 is a block diagram of the information providing apparatus 100 for the vehicle of Fig. 1. The structure thereof includes a user-customized mode setting unit (terminal) 210 to shift the information providing apparatus 100 for the vehicle into a user-customized mode, an input unit 211 to set various setting contents in carrying out the user-customized mode, a vehicle information terminal 212 and a multiplex communication input/output terminal (multiplex communication input/output unit) 213 that perform input/output of vehicle information, a vehicle interface (I/F) unit 201, a control unit

202 to perform the control of the information providing apparatus 100 for the vehicle, a first storage unit 203 including a ROM, for example, in which a processing program of the control unit 202 is stored, a second storage unit 204 including a nonvolatile memory, such as an EEPROM, to enable various settings by the input unit 211 to be registered for each user, a display part 101 to visually display various information, a drive unit 205 functioning as both a display control of the display part 101 and a drive control of various analog (dial type) meters 102, 103 and 104, and an aural information providing unit 240 including a speaker for aurally providing various information. The aural information providing unit 240 in this embodiment includes a sound/voice synthesizing unit (with a sound-mixing function) 241 to play sound/voice, an amplifier 242, an output terminal 243, an audio (audio device) 223 and a speaker 224. Besides, a time information gathering unit 208 to gather time information is connected to the control unit 202. The time information gathering unit 208 is an electric wave clock including an antenna 208a, a detection unit 208b and a decode unit 208c.

In the information providing apparatus 100 for the vehicle, a transmitter 221 and a receiver 222 of a keyless entry device 220 as a user identification unit, the car stereo 223, a traveling control device 225 to perform an automatic drive control of cruise-control traveling, automatic lane following

traveling or the like, and an operation unit 226 including an operation switch of the traveling control device 225 are connected through a multiplex communication line 230. Moreover, the control unit 202 can output an instruction signal for a volume mute instruction to the car stereo 223 through the multiplex communication input/output terminal 213 and the multiplex communication line 230.

Additionally, the operation of the information providing apparatus 100 for the vehicle will be described. The control unit 202 obtains data on a vehicle state relating to automatic traveling such as cruise controlled driving or automatic lane following traveling, warning information, and operation information relating to the operation of the cruise control driving or automatic lane following traveling from the vehicle information terminal 212 and the multiplex communication input/output terminal 213 which function in input/output of various vehicle information, informs various vehicle states relating to the automatic traveling such as the cruise control driving or automatic lane following traveling, the warning output, the guidance relating to the operation of the cruise control driving or automatic lane following traveling, and the answer-back system based on the various information based on those vehicle data as sound effect and voice sound via the aural information providing unit 240, and sends those signal to a display 101 to display the information relating to those aural

information.

Although the speaker 224 for the car stereo 223 is used in this embodiment, another speaker used only for the aural information providing unit 240 may be provided. Incidentally, the audio instruction is for providing, for example, the operation instruction for the user-customized registration by operating the input unit 211, and the answer-back system is for auditory responding to, for example, the setting condition of the automatic traveling, which is set by the operation unit 226 and is inputted through the multiplex communication input/output terminal 213, based on the operation of the operation unit 226.

Figs. 3(a) to 3(e) show specific examples of sound effects and voice sounds by the aural information providing unit 240 and display modes (images) by the display part 101.

Fig. 3(a) shows a state of a preceding vehicle at a time of cruise control driving. At the same time when the traveling control device 225 sets up the automatic traveling based on the certain operation of the operation unit 226, or after the automatic traveling is set, when a signal indicating that the preceding vehicle is detected at the time of the cruise control driving is inputted through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Preceding vehicle is detected" by

voice sound after a sound effect "pong". Next, when the control unit 202 receives a signal indicating that the vehicle is decelerated from the set speed to the speed of the preceding vehicle from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Decelerated traveling is performed" by voice sound. After that, the control unit 202 receives a signal indicating that the vehicle follows a vehicle ahead according to the speed of the preceding vehicle from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Following a vehicle ahead" by voice sound after a sound effect "pong". Incidentally, in order to display the notification content of the aural information providing unit 240, the control unit 202 controls the display part 101 to change the display mode of "decelerated driving" in the display part 101 in Fig. 3(a) to the display mode of "following a vehicle ahead".

Thus, the user (especially the driver) is able to aurally recognize the vehicle traveling state at the time of the cruise-control driving. Incidentally, the viewing information is also used by the display part 101.



Fig. 3(b) shows a case where the preceding vehicle changes the lane at the time of the cruise-control driving. When the control unit 202 receives a signal indicating that the preceding vehicle changes the lane from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Preceding vehicle changes the lane" after a sound effect "pong". Next, the control unit 202 receives a signal indicating that the vehicle is accelerated to the set speed from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Accelerating to the set speed" by voice sound. After that, when the control unit 202 receives a signal indicating that the vehicle performs constant speed traveling at the set speed through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Traveling at the set speed" by voice sound after a sound effect "pong". Moreover, the visual information is also used by the display part 101.

Fig. 3(c) shows an approaching warning of the preceding vehicle at the time of the cruise-control driving. When the

control unit 202 receives a signal indicating that the preceding vehicle is approaching from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Approaching the preceding vehicle. Please operate the break" by voice sound after beep sound. Incidentally, the visual information is also used by the display part 101.

Fig. 3(d) shows a lane deviation warning at the time of automatic lane following traveling. When the control unit 202 receives a signal indicating possibility of lane deviation at the time of the automatic lane following traveling from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "There is a possibility of lane deviation. Please control the steering wheel" by voice sound after beep sound. Incidentally, the visual information is also used by the display part 101.

Fig. 3(e) shows a case where cruise-control driving is set. When the control unit 202 receives a signal indicating that the traveling control device 225 is shifted to the cruise-control driving in accordance with a certain input of the operation unit 226 through the multiplex communication line

230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output, as the answerback, "Cruise-control system is activated" by voice sound after a sound effect "pong". Next, when the control unit 202 receives a signal to request a set speed from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output, as the instruction, "Please set vehicle speed" by voice sound.

Therefore, the user (especially the driver) is able to confirm the operation at the time of the cruise-control driving and to recognize a next required operation aurally by the aural information providing unit 240. Moreover, the visual information is also used through the display part 101.

Next, the operation of the control unit 202 at the time of input of warning information will be described using fig. 4. The control unit 202 obtains the information relating to the vehicle from the vehicle information terminal 212 and the multiplex communication input/output terminal 213 that perform the input/output of the vehicle information, and determines, based on this information, whether or not there is a warning occurrence condition. When the warning occurrence condition is detected, the warning information is produced by

a sound effect and a voice sound through the aural information providing unit 240, and the display mode relating to the warning information is displayed by the display part 101.

Fig. 4 shows a specific example thereof, and when the control unit 202 receives a signal indicating that a driver forget to pull out an ignition key at the time when the door is open through the vehicle information terminal 212 or the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output "Key remains inserted" by voice sound after a sound effect "pong". Moreover, the visual information is also used through the display part 101.

Therefore, the user (especially the driver) is able to accurately recognize the warning content. Since the visual information is also used, even if he/she fails to hear the voice sound output, it is possible to certainly recognize the information.

Next, the operation of the control unit 202 at the time of opening/ending will be described by use of Fig. 5. The control unit 202 obtains information relating to the vehicle from the vehicle information terminal 212 and the multiplex communication input/output terminal 213 that perform the input/output of the vehicle information, and determines, based on this information, whether or not there is an occurrence condition of the opening/ending. when the control unit 202

detects the occurrence condition of the opening/ending, the control unit 202 reads time information data of the time information gathering unit (electric wave clock) 208, the opening/ending corresponding to the time information is provided through the aural information providing unit 240, and the display mode relating to the opening/ending is displayed by the display part 101.

Figs. 5(a) to 5(c) show specific examples thereof, and Figs. 5(a) and 5(b) show examples in the case when it is detected that the door is open. The control unit 202 controls the aural information providing unit 240 to switch between "good morning" and "good evening" by voice sound based on the time information from the time information gathering unit 208. Moreover, the visual information is also used through the display part 101.

Therefore, it becomes possible to provide the user-friendly door opening system to the user. Since the electric wave clock is used as the time information gathering unit 208, it is unnecessary for the user to adjust the time of the clock, and makes it possible to correctly determine the current time.

Fig. 5(c) shows an example in the case when the control unit 202 detects the engine stops. The control unit 202 controls the aural information providing unit 240 so as to output "See you again" by voice sound. Moreover, the visual information is also used by the display part 101.

Fig. 6 shows an example of an audio mixing of voice and music at the time of the opening/ending. When detecting an opening/ending occurrence condition at T1, the control unit 202 initiates music output, reduces the music output at T2, mixes a voice with the music at T3, completes the voice output at T4 to return to the original music output, and ends the music output at T5.

Therefore, it becomes possible to provide the user-friendly door opening system to the user. Moreover, although the embodiment is carried out by using the audio mixing, it is not limited to this embodiment. For example, it goes without saying that the audio mixing of two different frequency sounds to produce a mixed sound in the case of an alarm condition occurs can be used.

Fig. 7 to 12 describe examples of the processes of the control unit 202 when more than one conditions to produce aural information overlap.

Fig. 7 shows an example at the time of cruise-control traveling. When the control unit 202 receives a signal indicating that speed setting is inputted at T10 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice (1) "Set vehicle speed is 60 km/h". When the control unit 202

receives a signal indicating that the preceding vehicle is approaching is inputted at T11 in the middle of the output from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice (2) "Preceding vehicle is detected" after the output of the voice (1) is completed. When the control unit 202 receives a signal indicating that the preceding vehicle is decelerated at T12 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice (3) "Decelerated traveling is performed" after the output of the voices (1) and (2) is completed. Next, when the control unit 202 receives a signal indicating that follow-up traveling of the preceding vehicle at T13 from the traveling control device 225, the control unit 202 controls the aural information providing unit 240 so as to output voice (4) "Follow-up traveling is performed" after the output of the voices (1), (2) and (3) is completed. However, when the control unit 202 receives a signal indicating that the cruise-control traveling is cancelled by the user at T14 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the

control unit 202 does not process the output signal for the voice sound which is still in a process of sending output, in other word, a standby output signal, or stops sending output signal which is in process, and controls the aural information providing unit 240 so as to output voice sound (5) "The cruise-control is cancelled".

Fig. 8 shows a first process occurs at the time of occurrence of warning information. When the control unit 202 receives respective two signals indicating warning information as vehicle information such as the warning information of forgetting to pull out the key from the ignition and to turn off the light at T20 through the vehicle information terminal 212, the control unit 202 controls the aural information providing unit 240 so as to output and repeat voice sound (10) "Key remains inserted" and voice sound (11) "Light remains turned on" alternately. when the control unit 202 receives a signal indicating that the warning information of forgetting to turn off the light is cancelled at T21 through the vehicle information terminal 212, the control unit 202 stops the output processing of the voice sound(11) and repeatedly carry out only the output processing of the voice sound (10).

Fig. 9 shows a second process occurs at the time of occurrence of warning information. When the control unit 202 receives respective two signals indicating warning



information as vehicle information such as the warning information of forgetting to pull out the key and the warning information of forgetting to turn off the light at T30 through the vehicle information terminal 212, the control unit 202 controls the aural information providing unit 240 so as to repeat voice sound(10) "Key remains inserted" after sound effect (15) "pong" and the voice sound(11) "Light remains turned on" after sound effect(16) "pong pong" alternately twice in accordance with the previously determined priority order. When the two warning information are continuously inputted at T31, the control unit 202 controls the aural information providing unit 240 so as to alternately repeat the sound effect(15) and the sound effect(16).

Fig. 10 shows a third process at the time of occurrence of warning information. When the control unit 202 receives respective two signals indicating warning information as vehicle information, that is, the warning information of forgetting to pull out the key and the warning information of forgetting to turn off the light are inputted at T40 through the vehicle information terminal 212, the control unit 202 controls the aural information providing unit 240 so as to repeat voice sound(10) "Key remains inserted" after sound effect (15) "pong" twice at specified intervals in accordance with the previously determined priority order, and so as to subsequently and continuously output only the sound effect (15).

When the control unit 202 receives a signal indicating that the warning information of forgetting to pull out the key is cancelled at T41 through the vehicle information terminal 212, the control unit 202 completes the output processing of the sound effect (15) and the voice sound(10), and controls the aural information providing unit 240 so as to repeat sound effect(16) "pong pong" and voice sound(11) "Light remains turned on" twice at specified intervals, and so as to subsequently continuously output only the sound effect(16). Incidentally, when the control unit 202 receives a signal indicating that the warning information of forgetting to turn off the light is cancelled at T42 through the vehicle information terminal 212, the control unit 202 completes the output processing of the sound effect (16).

Fig. 11 shows a priority process at the time of cruise-control traveling and automatic lane following traveling. When the control unit 202 receives a signal indicating that speed setting is performed at T50 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice sound(1) "Set speed is 80 km/h". In the case where the output conditions of voice sound(2) "Cruise-control driving is activated" at T51, voice sound(3) "Preceding vehicle is

detected" at T52, voice sound(4) "Decelerated traveling is performed" at T53, and voice sound(5) "Lane is detected" at T54 continuously occur in the middle of this output process, the control unit 202 controls the aural information providing unit 240 to leave the information important for the safety of traveling (information with high priority), that is, the voice sound (3) "Preceding vehicle is detected" and the voice sound(5) "Lane is detected" , and omits the other voices (2), (4) and (6). In this process, when the several information (1), (2), (3), (4) and (5) are sequentially provided in accordance with priority order, in the case where the number of information not provided and the number of information being on the waiting list is more than a specified number (for example, 3), a specified number (for example, 2) of information with high priority are announced, and the notification operation of the other information are omitted, and the overlapped various information are not continuously provided, and accordingly, the operation of the control unit 202 can be more user-friendly. In other words, the control unit 202 performs the simplifying process for the providing operation of the overlapped various information, so that the user can easily recognize only the information with high priority.

Fig. 12 shows a process in a case having urgency at the time of cruise-control traveling. When the control unit 202 receives a signal indicating that vehicle speed setting is

performed at T60 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice sound (1) "Set speed is 80 km/h". When the control unit 202 receives a signal indicating that cruise-control traveling is performed at T61 from the traveling control device 225 in the middle of the output through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice sound (2) "Cruise-control driving is activated" after the output process of the voice sound (1) is completed. When the control unit 202 receives a signal indicating that the preceding vehicle is detected at T62 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 controls the aural information providing unit 240 so as to output voice sound (3) "Preceding vehicle is detected" after the output process of the voice sound (1) and (2) is completed. Next, the control unit 202 receives a signal indicating that the preceding vehicle is decelerated at T63 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 is in a standby

state for performing the output process of voice sound (4) "Decelerated traveling is performed" after the output processes of the voices sound (1), (2) and (3) are completed. However, when the control unit 202 receives a signal indicating that the preceding vehicle is approaching, which is determined to be an urgency condition, at T64 from the traveling control device 225 through the multiplex communication line 230 and the multiplex communication input/output terminal 213, the control unit 202 performs an interruption processing even in the middle of output process of the voice sound (3) and controls the aural information providing unit 240 so as to output voice sound (5) "Approaching to the preceding vehicle. Please operate the break".

Next, a user-customized function in the control unit 202 will be described by using Fig. 13. The user of the vehicle operates the user-customized mode setting unit 210 from the outside of the vehicle information providing device and gives an instruction to make a shift to a user-customized mode (function) which the control unit 202 previously has. Specifically, this is performed by changing the terminal whose normal potential is at a high level to a low level by a switch or the like. When the shift to the user-customized mode occurs, the control unit 202 changes the display part 101 from a normal display to a user-customized setting mode initial screen through the drive unit 205. The user registers various setting

contents relating to the aural information output through the input unit 211. The user-customized setting can be performed for each user of the vehicle, and the setting contents are stored in the second storage unit 204 for each user. Then the setting contents are automatically read based on the specific user information from the user identification unit such as the keyless entry device 220.

Figs. 13(a) to 13(d) show specific user-customized contents of aural information output items from the aural information providing unit 240. Fig. 13(a) shows a screen on which it is possible to select whether or not the user uses voice output in cruise-control traveling/automatic lane following traveling. Besides, Fig. 13(b) shows a screen on which it is possible to select whether or not the user uses voice output in the state notification of cruise-control traveling/automatic lane following traveling, warning, guidance of an operation, answerback, and the like. Fig. 13(c) shows a screen on which it is selected whether or not the user uses visual information by the display part 101 with the voice output of the alarm information. Fig. 13(d) shows a screen on which it is selected whether or not the user chooses to link the time of voice output of opening/ending to the current time.

The information providing apparatus 100 for the vehicle includes the control unit 202 that inputs the traveling information relating to the automatic traveling of the vehicle

and the operation information relating to the automatic traveling for the user through the vehicle information terminal 213 or the multiplex communication input/output terminal 214, and activates the aural information providing unit 240 to announce at least one state of the vehicle relating to the automatic traveling, the warning relating to the automatic traveling, the guidance of the operation relating to the automatic traveling, and the answer-back system of the operation relating to the automatic traveling. Besides, the control unit 202 provides various information by using the aural information providing unit 240 and by voice sound. Besides, the control unit 202 causes the display part 101 as the visual information providing unit to perform the display operation associated with the aural information providing unit 240.

Therefore, the state notification of the vehicle of the cruise-control traveling/automatic lane following traveling and the warning output are outputted by voice sound, so that it is possible to reduce the eye movement of the user for visualizing the display part 101 during the driving, and accordingly, the information providing apparatus for the vehicle which contributes to the safety driving can be obtained. Furthermore, the guidance relating to the operation of the cruise-control traveling/automatic lane following traveling and the answer-back system are outputted by voice sound, so

that the operability for the user can be improved. Besides, the visual information, coordinated with the aural information, is used by the display part 101, so that the user can certainly make the recognition, and the convenience can be improved.

Besides, the control unit 202 uses the aural information providing unit 240 to provide various information by the combination of the voice sound and the sound effect. Besides, the control unit 202 activates the aural information providing unit 240 so as to give the sound effect according to various states of the guidance, warning, answer-back system and the like, and changes the sound effect for each of the various states.

Accordingly, since the sound effect is used, it is possible to deal with the auditory defect related to the user's aging (in general, the sound effect uses a frequency band of 1 to 2 KHz and it is easy for the user to hear), and since the sound effect is changed according to the various states, it becomes easy for the user to make the recognition, and the convenience can be improved.

Besides, the control unit 202 inputs the vehicle information through the vehicle information terminal 212 or the multiplex communication input/output terminal 213, activates the aural information providing unit 240 for at least the warning content (alarm, warning) in the vehicle information by the combination of the sound effect and the voice sound,



and changes the sound effect for each warning content.

Therefore, the user can certainly make the recognition, and the convenience can be improved. Besides, the control unit 202 uses the visual information by the display part 101 as well as the aural information, so that the user can certainly recognize the warning content.

Besides, since the control unit 202 repeatedly activates the aural information providing unit 240 for the warning content by the combination of the sound effect and the voice sound and the aural information providing unit 240 by only the sound effect in the repeated operation after a specified number of times, the voice is not repeated after the user recognizes the warning content, and therefore, annoyance caused according to the individual difference of the user is eliminated, and the convenience can be more improved.

Besides, the control unit 202 inputs the vehicle information through the vehicle information terminal 212 or the multiplex input/output terminal 213, and activates the aural information providing unit 240 so as to provide the content at the time of the opening or ending, and it becomes possible to provide the representation friendly to the user.

Besides, when the control unit 202 activates the aural information providing unit 240 to provide the content of the opening or ending, the audio mixing of the voice and the music is performed for the opening or ending, and the time information

is added to the content to change the content of the opening or ending, and therefore, it becomes possible to provide more user-friendly device. Besides, since the electric wave clock or GPS is used as the time information gathering unit, it is unnecessary for the user to correct the clock, the time determination can be made based on the accurate time, and the convenience is further improved.

Besides, when the control unit 202 activates the aural information providing unit 240 to provide various information, in the case where the audio 223 is operated in a normal state, the mute process to reduce the output processing of the audio 223 is performed, so that the user can certainly hear various information.

Besides, when plural conditions for aural notification are inputted through the vehicle information terminal 212 or the multiplex communication input/output terminal 213, the control unit 202 activates the aural information providing unit 240 so as to sequentially provide the various information in the previously determined descending order of priority, and the information is notified in accordance with the priority, and therefore, it becomes possible to sequentially inform the user of the information in the descending order of importance.

Besides, at the time when the information is sequentially notified in the descending order of priority, when the signal indicating that information not notified and on the waiting

list is cancelled is inputted through the vehicle information terminal 212 or the multiplex communication input/output terminal 213, the control unit 202 cancels the notification operation of the content corresponding to the signal, and does not notify the information whose occurrence condition is cancelled, and therefore, the user does not feel an unpleasant feeling, and the convenience is further improved.

Besides, at the time when more than one information are sequentially provided in accordance with the priority, in the case where the number of information not provided and on the waiting list is larger than that of a specified number, the control unit 202 leaves a specified number of information having high priority, and omits the notification operation of the other information, and the various information having low priority are not continuously provided, and therefore, it is possible to prevent the user from feeling annoyance.

Besides, at the time when more than one information are sequentially provided in accordance with the priority, when the information requiring urgency is inputted through the vehicle information terminal 212 or the multiplex communication input/output terminal 213, the control unit 202 forces the information requiring the urgency into the information not provided and on the waiting list, and causes the information requiring the urgency to be provided with priority by the aural information providing unit 240, and the

safety in vehicle traveling can be improved.

Besides, the control unit 202 has the user-customized mode to register various settings of the aural information providing unit 240, and includes the input unit 211 to determine the contents of the various settings and the second storage unit 204 to register the contents of the various settings, and accordingly, the contents of the various settings can be user-customized, and the information providing apparatus 100 for the vehicle according to the user's preference can be obtained.

[Industrial Applicability]

The invention relates to the information providing apparatus for the vehicle using the aural information providing unit, and can be applied to not only a vehicle display apparatus to provide vehicle information, but also vehicle information providing apparatus, such as an audio apparatus, a navigation apparatus or a multi-display apparatus, mounted in the vehicle.

[Designation of Document] Claims

[Claim 1]

An information providing apparatus for a vehicle comprising an aural information providing unit to aurally provide a user various states of a vehicle, characterized in comprising:

a control unit that inputs traveling information relating to automatic traveling of the vehicle and operation

information relating to the automatic traveling for a user through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information providing unit to provide at least one state of a vehicle state relating to the automatic traveling, a warning relating to the automatic traveling, a guidance of an operation relating to the automatic traveling, and an answer-back system of the operation relating to the automatic traveling.

[Claim 2]

The information providing apparatus for the vehicle as recited in claim 1, characterized in that a visual information providing unit is provided to visually display the various states of the vehicle, and the control unit causes a display mode relating to notification content of the aural information providing unit to be displayed by the visual information providing unit.

[Claim 3]

The information providing apparatus for the vehicle as recited in claim 1, characterized in that the control unit uses the aural information providing unit to send a notification by voice sound.

[Claim 4]

The information providing apparatus for the vehicle as recited in claim 1, characterized in that the control unit uses

the aural information providing unit to send a notification by a combination of voice sound and a sound effect.

[Claim 5]

The information providing apparatus for the vehicle as recited in claim 4, characterized in that the control unit activates the aural information providing unit to give the sound effect according to the various states of the audio instruction, the warning and the answer-back system, and changes the sound effect for each of the various states.

[Claim 6]

An information providing apparatus for a vehicle comprising an aural information providing unit to aurally notify various states of a vehicle, characterized in that

the control unit inputs information of the vehicle through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information providing unit for at least warning contents in the information by a combination of a sound effect and a voice sound, and changes the sound effect for each of the warning contents.

[Claim 7]

The information providing apparatus for the vehicle as recited in claim 6, characterized in that the control unit repeatedly activates the aural information providing unit for the warning contents by the combination of the sound effect

and the voice sound, and activates the aural information providing unit by only the sound effect in the repeated operation after a specified number of times.

[Claim 8]

An information providing apparatus for a vehicle comprising an aural information providing unit to aurally provide various states of a vehicle, characterized in comprising:

a control unit that inputs information of the vehicle through at least one of a vehicle information terminal and a multiplex communication input/output unit, and activates the aural information providing unit to provide content of at least one of an opening and an ending based on the information.

[Claim 9]

The information providing apparatus for the vehicle as recited in claim 8, characterized in that the control unit activates the aural information providing unit by mixing of voice sound and music.

[Claim 10]

The information providing apparatus for the vehicle as recited in claim 6 or 8, characterized in that the control unit activates the visual information providing unit as well as the aural information providing unit.

[Claim 11]

An information providing apparatus for a vehicle

comprising visual information providing unit to visually display various states of a vehicle, an aural information providing unit to aurally provide the various states, and a control unit to control the visual information providing unit and the aural information providing unit, characterized in that

the control unit inputs information of the vehicle through at least one of a vehicle information terminal and a multiplex communication input/output unit, activates the aural information providing unit for at least information relating to warning content in the information, and activates the visual information providing unit as well as the aural information providing unit.

[Claim 12]

The information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, characterized in that a time information gathering unit is provided to gather time information, and the control unit inputs the time information, and provides information corresponding to the time information by the aural information providing unit.

[Claim 13]

The information providing apparatus for the vehicle as recited in claim 12, characterized in that the time information gathering unit includes an electric wave clock or a GPS.

[Claim 14]

The information providing apparatus for the vehicle as



recited in any one of claims 1, 6, 8 and 11, characterized in that when activating the aural information providing unit, the control unit outputs an instruction signal to reduce output of an audio device mounted in the vehicle through at least one of the vehicle information terminal and the multiplex communication input/output terminal.

[Claim 15]

The information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, characterized in that when detecting plural conditions for aural notification through at least one of the vehicle information terminal and the multiplex communication input/output terminal, the control unit activates the aural information providing unit to sequentially provide respective information corresponding to a previously determined descending order of priority.

[Claim 16]

The information providing apparatus for the vehicle as recited in 15, characterized in that when the control unit receives a signal indicating that information on a waiting list is cancelled through at least one of the vehicle information terminal and the multiplex communication input/output terminal at the time when the information are sequentially provided in the descending order of priority, the control unit cancels a notification operation of the information corresponding to the signal.

## [Claim 17]

The information providing apparatus for the vehicle as recited in claim 15, characterized in that when the plural information are sequentially provided in accordance with the priority, in the case where the number of information not provided and being on a waiting list is larger than that of a specified number, the control unit leaves a specified number of information having high priority and omits a notification operation of the other information.

## [Claim 18]

The information providing apparatus for the vehicle as recited in claim 15, characterized in that when information requiring urgency is inputted through at least one of the vehicle information terminal and the multiplex communication input/output terminal at the time when the plural information are sequentially provided in accordance with the priority, the control unit forces the information requiring the urgency into the information not provided and being on a waiting list, and causes the information requiring the urgency to be provided with priority by the aural information providing unit.

## [Claim 19]

The information providing apparatus for the vehicle as recited in any one of claims 1, 6, 8 and 11, characterized in that the control unit has a customize mode to register various settings of the aural information providing unit, and includes

an input unit to determine contents of the various settings in the user-customize mode, and a storage unit to register the contents of the various settings.

[Designation of Document] Abstract

The invention provides an information providing apparatus for a vehicle which can reduce the eye movement of the user during driving by using an aural information providing unit. A subject information providing apparatus 100 for a vehicle includes an aural information providing unit 240 to aurally provide various states of a vehicle. A control unit 202 inputs traveling information relating to automatic traveling of the vehicle and operation information relating to the automatic traveling for a user through at least one of a vehicle information terminal 212 and a multiplex communication input/output unit 213, and activates the aural information providing unit 240 to notify at least one state of a audio instruction relating to the automatic traveling, a warning relating to the automatic traveling, and an answer-back system relating to the operation information.